

Supplement to
Las Campanas de Santa Fe
Water Supply Project
Rio Grande Water Surface Profiles

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December 1, 2001

prepared for CH2M-Hill, Albuquerque Office

Executive Summary

This supplement confirms the findings of the October 11 report of the same name. The channel has been more precisely surveyed in the region of the intake. The channel bed has not appreciably altered. The intake has been moved approximately 60 feet downstream to take advantage of natural scour. The intake's hydraulic effect on the river remains minor and the geomorphologic effect remains negligible.

Objective

Water surface profiles in the October 11 document were based on May 2001 survey at 3050 cfs. This supplemental report incorporates November 20 survey data in the vicinity of the proposed intake. Approximate 600-cfs discharge improved access to the channel bed.

This report deals with changes resulting from the November survey. Portions of the October report not explicitly updated remain as written.

Stations

Stationing correction: November survey mapping is in accord with October HEC-RAS labels. That HEC-RAS stationing, however, is 1000 feet offset from that of the October report text. (The Canada Ancha Arroyo, the lower end of the model, was 0+00 in the text, but 10+00 in the HEC-RAS labels. My error.) The offset, carried upstream, has no effect on the computations. This supplement and the revised HEC-RAS employ the October report stationing. Station 0+00 is the Canada Ancha. Subtract 10+00 from each station the November map.

Only the channel bed between Stas. 14+00 and 7+50 (corrected stations) was surveyed in November. Stations upstream and downstream, as well as the overbank at 600 cfs, remain the May survey. The following table indicates cross-sections in downstream order.

X-Sec	Station	Change from May survey
13	24+00	Unchanged
12	22+00	Unchanged
11	20+00	Unchanged
10	18+00	Unchanged
9	16+00	Unchanged
8	14+00	Updated
7	12+00	Updated
6.6	11+24	Deleted
6.5	11+00	Updated
6.4	10+75	Updated
Intake 6.2	10+38	New
6	10+00	Updated
5	8+00	Updated
4	6+00	Unchanged
3	4+00	Unchanged
2	2+00	Unchanged
1	0+00	Unchanged

In the October report, the intake was at Sta. 6.5. Stas. 6.6 and 6.4, not surveyed in May, were generated by shifting Sta. 6.5 25 feet up- and downstream to bracket the intake. The intake is now moved to Sta. 6.2 for reasons discussed later. Stas. 6.4 and 6 now provide the brackets. Sta. 6.6, serving no current purpose, is deleted.

Natural Channel

Following are HEC-RAS water surface elevations at 3050 cfs, the benchmark discharge for calibration. Elevations in this report employ a 5,400-foot datum, e.g., elev. 55 = 5,455 feet.

Water Surface			
X-Sec	Station	Survey Geometry	
		May	November
13	24+00	62.6	62.5
12	22+00	62.2	62.2
11	20+00	61.7	61.6
10	18+00	61.5	61.4
9	16+00	61.2	61.0
8	14+00	60.8	60.6
7	12+00	60.5	60.3
6.5	11+00	60.1	60.0
6	10+00	60.1	60.1
5	8+00	60.0	60.0
4	6+00	59.8	59.8
3	4+00	59.0	59.0
2	2+00	59.0	59.0
1	0+00	58.3	58.3

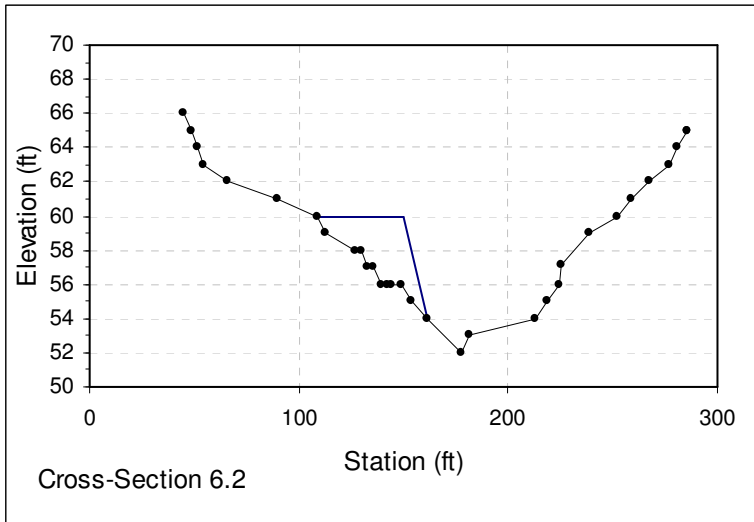
The November survey shows the channel bed between Cross-Sections 7 and 6 to be slightly lower than that inferred from the May data. The HEC-RAS consequence is slightly lower upstream depths. HEC-RAS depths downstream of the November survey (Cross-Sections 4-1) are unchanged.

In overall appraisal, the November survey does not change the profile. Adjusting the May-based profiles by one or two tenths of a foot at a few locations is not justified. For 0.1-foot accuracy, the entire half-mile of the Rio Grande needs to be surveyed with the November diligence, not 200-foot intervals. Ensuing profile detail would not improve intake design to any meaningful degree.

The Intake

The intake is now moved 68 feet downstream of its October-report site, placing the structure at Sta. 10+38, a natural scour hole documented in the November survey. Scour hole elevation is 52 feet. The May survey did not catch this detail.

The move makes sense. The deeper cross-section allows the intake's top to be dropped from elevation 61 (that of the October report) to elevation 60, more effective in low-flow periods. This report assumes the intake top to be at elevation 60, but it could be left at 61. The figure illustrates the new intake, Cross-Section 6.2.



The intake floor is not set at the absolute bottom of the scour hole, as the latter might refill with gravel. Water surface elevations at the intake are as follows.

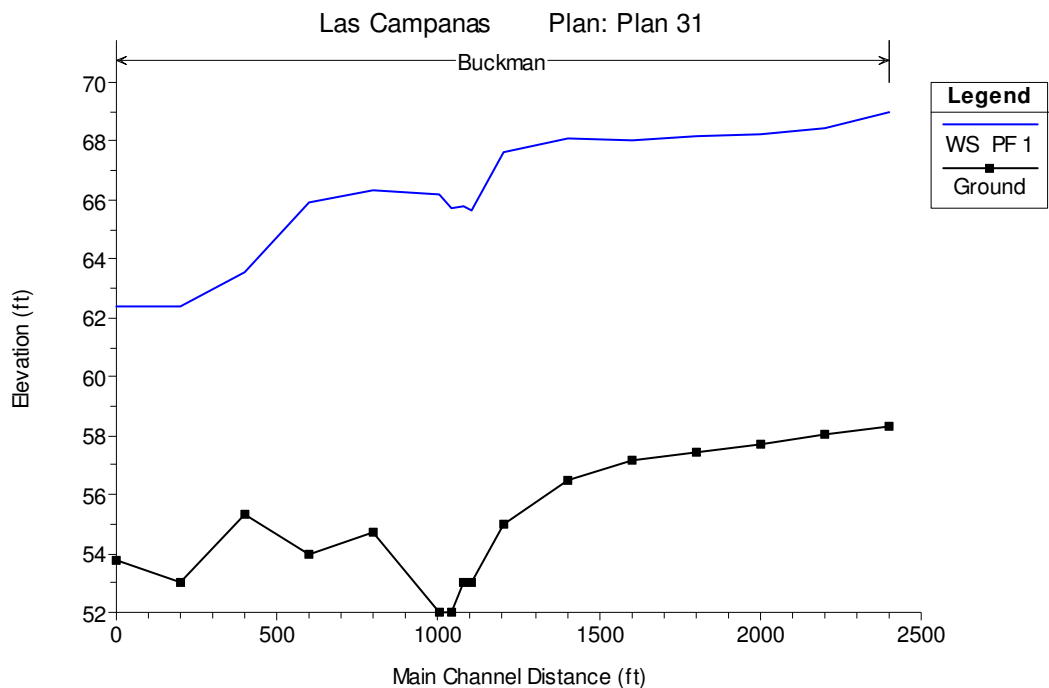
Discharge (cfs)	Elev. (ft)	
	Existing	Intake
150	56.54	56.54
200	56.72	56.72
300	57.01	57.00
500	57.44	57.43
700	57.79	57.77
1,000	58.21	58.18
2,000	59.28	59.18
5,000	61.28	61.04
10,000	63.53	63.21
20,000	66.76	66.37

As with the May survey, the intake acts as a choke in a subcritical flow. The water surface dips. As with the May survey, the contraction results in a water surface drop of roughly 0.2 feet at 3,000 cfs. These elevations relate to screen-submergence, detail pertinent to final design.

The top of the intake screen is roughly 3 feet below the top of the intake structure. Screen elevation is thus approximately 54 to 57. The table indicates that the screen will be submerged at roughly 300 cfs.

The 100-Year Event

Following is the 100-year (17,800 cfs) profile with the intake in place.



The table shows the backwater effect.

Cross-Section	Elev. (ft)	
	Existing	Intake
13	68.98	68.99
12	68.44	68.45
11	68.24	68.26
10	68.13	68.14
9	68.05	68.06
8	68.09	68.10
7	67.62	67.63
6.5	65.57	65.62
6.4	65.73	65.78
6.2	66.12	65.74
6	66.18	66.18
5	66.36	66.36
4	65.90	65.90
3	63.51	63.51
2	62.42	62.42
1	62.39	62.39

One sees the 0.38-foot dip at the intake. Cross-Section 7, the backwater consequence, however, is only 0.01 foot.

As with the May model, the rise in water surface passing the intake is due to channel expansion, not a hydraulic jump.

Further Study

Revise Cross-Section 6.2 in HEC-RAS if the intake final design significantly differs from that shown above. The intake would have to be significantly more intrusive, however, before meaningful difference occurs in the water surface.

Visually monitor the scour hole at Sta. 10+38. As this is a narrow reach, local scour is expected.

100-Year Profile Summary

Sta	Q	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
13	17800	58.30	68.99		70.17	0.000961	9.13	2485.67	314.62	0.52
12	17800	58.03	68.45		69.93	0.001217	10.04	2116.31	274.69	0.58
11	17800	57.73	68.26		69.66	0.001202	10.03	2411.77	350.58	0.57
10	17800	57.45	68.14		69.40	0.000984	9.43	2535.71	380.28	0.52
9	17800	57.18	68.06		69.17	0.000869	8.74	2566.42	372.29	0.49
8	17800	56.50	68.10		68.94	0.000654	7.77	3026.01	364.08	0.43
7	17800	55.00	67.63		68.76	0.000820	8.89	2540.04	310.42	0.48
6.5	17800	53.00	65.62		68.46	0.002301	13.94	1576.52	226.78	0.79
6.4	17800	53.00	65.78		68.32	0.001909	13.16	1666.65	228.21	0.72
6.2	17800	52.00	65.74		68.23	0.002195	12.99	1684.35	294.17	0.76
6	17800	52.00	66.18		67.95	0.001225	10.94	2006.75	314.79	0.59
5	17800	54.70	66.36		67.57	0.000845	8.95	2299.82	358.64	0.49
4	17800	54.00	65.90	63.03	67.35	0.001154	9.80	2068.32	290.96	0.56
3	17800	55.34	63.51	63.51	66.79	0.003820	14.62	1309.64	232.29	0.97
2	17800	53.00	62.42	62.06	65.31	0.003302	13.69	1370.43	257.19	0.90
1	17800	53.79	62.39	61.91	64.39	0.003301	11.38	1616.94	345.19	0.86